

UNITED STATES MARINE CORPS
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Training Command
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AQM 6309

MULTIMETER EXERCISE WORKBOOK

RESISTANCE TESTS GENERAL

Look at the upper section of the breadboard. This section provides the capability for you to perform realistic tests in each of the multimeter's resistance test ranges.

The top row of resistances enable you to perform three measurements in the 200 ohm's resistance range.

The second row of resistances provide two tests in the 2K range, and one in the 20K range.

The bottom row of resistances provide for one test in the 20K range, one test in the 200K range and one test in the 2000K or 2M range.

In the exercises that follow, you will be required to measure resistance in all test ranges. Nine tests in all.

TESTING IN THE 200 OHM RESISTANCE RANGE

1. Connect the ends of the test leads to Jack No. 1 and Jack No. 2. Read the meter, then complete the following sentence:

The resistance between Jack No. 1 and Jack No. 2 is _____ ohms.

2. Move the test leads to Jack No. 3 and Jack No. 4. Read the meter, then complete the sentence:

The resistance between Jack No. 3 and Jack No. 4 is _____ ohms.

3. Move the test leads to Jack No. 5 and Jack No. 6. Read the meter and complete the sentence:

The resistance between Jack No. 5 and Jack No. 6 is _____ ohms.

TESTING IN THE 2K OHMS RESISTANCE RANGE

4. Connect the test leads to Jack No. 7 and Jack No. 8. Read the meter and complete the sentence:

The resistance between Jack No. 7 and Jack No. 8 is _____ ohms.

5. Move the test leads to Jack No. 9 and Jack No. 10. Read the meter and complete the sentence.

The resistance between Jack No. 9 and Jack No. 10 is _____ ohms.

TESTING IN THE 20K OHMS RESISTANCE RANGE

6. Move the test leads to Jack No. 11 and Jack No. 12. Read the meter and complete the sentence.

The resistance between Jack No. 11 and Jack No. 12 is _____ ohms.

7. Connect the test leads to Jack No. 13 and Jack No. 14. Read the meter and complete the sentence.

The resistance between Jack No. 13 and Jack No. 14 is _____ ohms.

TESTING IN THE 2000K OR 2M OHMS RESISTANCE RANGE

8. Move the test leads to Jack No. 15 and Jack No. 16. Read the meter and complete the sentence.

The resistance between Jack No. 15 and Jack No. 16 is _____ ohms.

9. Move the test leads to Jack No. 17 and Jack No. 18. Read the meter and complete the sentence.

The resistance between Jack No. 17 and Jack No. 18 is _____ ohms.

DISCONNECT THE TEST LEADS FROM THE BREADBOARD

TURN THE MULTIMETER OFF

VOLTAGE TESTS

GENERAL

Refer to the lower left section of the breadboard marked voltage tests. This section provides the capability for you to perform realistic tests in the multimeter's voltage test ranges.

Take a moment to look at the selector switch; it has nine distinct positions. You will use only the first two positions for the voltage tests. Notice also that Jack No. 19 and Jack No. 20 are located in this section. Jack No. 19 is negative, and Jack No. 20 is positive.

PREPARATION OF MULTIMETERS

Position the power switch in the "On" position and make sure the function switch is set in the DC position and the test leads are properly connected to the multimeter. Polarity is important. The red test lead is positive and the black test lead is negative.

PREPARATION OF THE BREADBOARD

The power switch is located on the left side of the breadboard housing and must be turned to the "On" position. Make sure it is. The volt test selector switch must be in the "Off" position. Be certain that it is.

PREPARE YOURSELF

You will be measuring voltage, so always be polarity conscious. The voltage measurements that you will perform are designed to test your ability to correctly interpret voltage readings with the multimeter.

TESTING VOLTAGE

Connect the multimeter's test leads to Jack No. 19 and Jack No. 20. Turn the selector switch to position No. 1.

10. Select the 200 volt DC range on your multimeter. Read the meter and complete the following sentence:

In the 200 volt test range, the meter indicated _____ volts.

11. Set your meter to the 20 volt DC range. Read the meter and complete the following sentence.

In the 20 volt test range, the meter indicated _____ volts.

TURN THE SELECTOR SWITCH TO POSITION NO. 2

12. Select the 200 volt DC range on your multimeter. Read the meter and complete the sentence.

In the 200 volt test range, the meter indicated _____ volts.

13. Set your multimeter to the 20 volt DC range. Read the meter and complete the sentence.

In the 200 volt test range, the meter indicated _____ volts.

TURN THE SELECTOR SWITCH TO THE "OFF" POSITION.

DISCONNECT THE TEST LEADS FROM THE BREADBOARD

VOLTAGE LOSS TESTS

GENERAL

Refer to the lower right section of the breadboard marked "Voltage Loss Tests". That section provides the capability for you to perform realistic measurements of voltage loss.

The section features three representative electrical circuits, including: a simple circuit with one using component, a series circuit with two using components and a parallel circuit with three branches.

The displayed circuits are activated by the selector switch. Position A activates the simple circuit, position B the series circuit and position C the parallel circuit.

PREPARATION OF THE MULTIMETER

The function switch must be in the DC position.

Check the test lead connections at the multimeter. Polarity is important.

TEST RESISTANCE, VOLTAGE AND VOLTAGE LOSS

SIMPLE CIRCUIT

14. Select the 200 ohm resistance range. Connect the test leads to Jack No. 21 and Jack No. 22. Read the meter.

The resistance of the lamp in the simple circuit is _____ ohms.

15. Select the proper DC voltage range to measure voltage at Lamp No. 1. Attach the positive test lead to Jack No. 21 and the negative test lead to vehicle. Turn the selector switch to position A. Read the meter.

The voltage available at Lamp No. 1 is _____ volts.

16. Move the negative test lead to Jack No. 22. Read the meter.

The voltage loss across Lamp No. 1 is _____ volts.

17. Move the negative test lead to Jack No. 19 vehicle ground. Move the positive test lead to Jack No. 22.

The voltage available at the ground side of Lamp No. 1 is _____ volts.

18. Measure the resistance of Lamp No. 2.

The resistance of Lamp No. 2 is _____ ohms.

19. Measure the resistance of Lamp No. 3.

The resistance of Lamp No. 3 is _____ ohms.

20. Measure the resistance of Lamp No. 2 and 3.

The combined resistance of Lamp No. 2 and 3 is _____ ohms.

TURN THE SELECTOR SWITCH TO POSITION B

21. Measure the voltage at Lamp No. 2 (Jack No. 23).

There are _____ volts available at Lamp No. 2.

22. Measure the voltage loss across Lamp No. 2.

Voltage loss across Lamp No. 2 is _____ volts.

23. Measure the voltage at Lamp No. 3 (Jack No. 25).

There are _____ volts available at Lamp No. 3.

24. Measure the voltage loss across Lamp No. 3.

Voltage loss across Lamp No. 3 is _____ volts.

25. Measure the combined voltage loss across both lamps (Jack No. 23 and Jack No. 26).

The voltage loss between Jack No. 23 and Jack No. 26 is _____ volts.

26. Measure the total voltage loss in the circuit (Jack No. 23 and vehicle ground).

The total voltage is _____ volts.

27. Read statements No. 21 and No. 26. Complete the following:

_____ volts are available to power the circuits.

_____ volts are expended by the two lamps.

28. Prove it. Measure the voltage that is available at the ground side of Lamp No. 3 (Jack No. 26 and Jack No. 19 vehicle ground).

The voltage available at Jack No. 26 is _____ volts.

DISCONNECT THE TEST LEADS FROM THE BREADBOARD

PARALLEL CIRCUIT

29. Measure the resistance of each lamp in the parallel circuit.

The resistance of Lamp No. 4 is _____ ohms.

The resistance of Lamp No. 5 is _____ ohms.

The resistance of Lamp No. 6 is _____ ohms.

TURN THE SELECTOR SWITCH TO POSITION C

30. Measure the voltage that is available at each branch in the parallel circuit.

The voltage available at Lamp No. 4 is _____ volts.

The voltage available at Lamp No. 5 is _____ volts.

The voltage available at Lamp No. 6 is _____ volts.

31. Measure the voltage loss across each lamp in the parallel circuit.

The voltage loss across Lamp No. 4 is _____ volts.

The voltage loss across Lamp No. 5 is _____ volts.

The voltage loss across Lamp No. 6 is _____ volts.

MOVE THE NEGATIVE TEST LEAD TO JACK NO. 19

32. Measure the available voltage at the ground side of each lamp in the parallel circuit.

The voltage available at Jack No. 28 is _____ volts.

The voltage available at Jack No. 30 is _____ volts.

The voltage available at Jack No. 32 is _____ volts.

33. Read statements No. 30, No. 31 and No. 32. Then enter the voltage in the space provided.

VOLTAGE <u>AVAILABLE</u>	VOLTAGE <u>LOSS</u>
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First Branch (Lamp No. 4)

Second Branch (Lamp No. 5)

Third Branch (Lamp No. 6)

TURN THE BREADBOARD SWITCH TO THE "OFF" POSITION.

DISCONNECT THE TEST LEADS FROM THE BREADBOARD AND THE MULTIMETER.

TURN THE MULTIMETER OFF.

TURN THE BREADBOARD SWITCH TO THE OFF POSITION.